TANGANYIKA

MINISTRY OF AGRICULTURE

Annual Report

of the

Department of Agriculture

1961

PART II

(Research)

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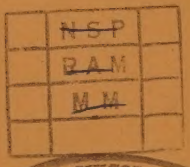

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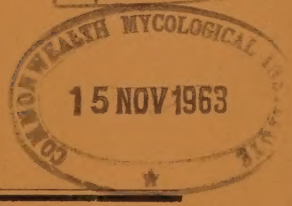

Annual Report

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Department of Agriculture

1961

PART II

(*Research*)

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TANGANYIKA

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, 1961

PART II

INTRODUCTION

Staff changes were few during the year. Mr. D. G. Jones, Senior Research Officer, Mr. C. Glegg and Mr. D. Obsbourn, Agricultural Officers and Mr. I. Thompson, Senior Field Officer resigned. Mr. W. H. T. Peregrine and Mr. D. R. W. Watson, Plant Pathologists, Mr. M. P. Collinson, Agricultural Economist and Mr. B. B. Masambaji, Mr. H. Kayumbo and Mr. A. Tsakiris, Experimental Officers, were engaged.

Mr. B. Simon, Mr. B. B. Masambaji, Mr. H. Kayumbo and Mr. A. Sreedharan were on advanced training courses in the United States of America and Great Britain.

A number of officers attended the various specialist committees organized by the East African Agricultural and Forestry Research Organization and Dr. A. C. Evans served on a commission to advise on the best structure for the management, direction and financing of research on an East African basis.

During the year responsibility was assumed for the Pasture Research Station, at Kongwa, which had been developed by the Tanganyika Agricultural Corporation.

1961 was generally a dry year and in some areas severe drought conditions were experienced. But in general yields were good.

Progress was made in soil fertility work and evidence accumulated to the effect that continued applications of fertilizers and manure can progressively improve soil productivity. There was a suggestion on certain sandy soils that continued use of sulphate of ammonia was definitely lowering pH.

With the provision of seed dressings containing a much higher content of active ingredient, progress was made in the use of these materials for the control of termites.

The Commonwealth pool of Entomologists has stationed an officer at the E.A.A.F.R.O. headquarters to co-ordinate all work on army-worm. In Tanganyika the Entomologist at Tengeru is responsible for local co-ordination.

In the Southern Region tests were begun to compare the productivity of local cropping systems.

The programme of research on cashew was continued. A brief study of the flower biology suggested that pollination is not a factor limiting yield. The trees which were grown from nuts of varying specific gravity are showing the superiority of the high specific gravity seed in their early nut yields. Among a large collection of foreign varieties the local Tanganyika trees are generally the best yielders.

Further progress was made in cotton breeding and arrangements were made at Ukiriguru for a Uk 61 seed issue while plans are far advanced for a Uk 62 issue. UPA selections growing at Ilonga in the Eastern Region are very promising. Fusarium wilt is still slowly spreading in the Lake Region. There is also an increase in this Region in the incidence of pink bollworm (*Earias* spp.).

Work on the selection of a pale skinned nut from the Mwitundi groundnut variety, continued at Nachingwea. Some very promising material has been obtained which gives indications that it will out-yield the bulk from which it was selected.

Hibiscus (kenaf) yielded 1,650 lb. per acre of clean fibre in the Eastern Region but the great variability of the material suggests that this performance could be much improved by simple selection.

Some useful progress was made in unravelling the problem of the hybrid sisal disease complex.

The commercial planting of new soya bean varieties at Nachingwea was successful. Trials of these varieties in other areas show that they are likely to prove much more adaptable than had been thought likely.

STAFF—RESEARCH DIVISION

(As at 31st December, 1961)

Headquarters

Chief Research Officer: A. C. Evans, B.Sc. (Bristol), D.I.C., Ph.D. (London).
Experimental Officer: A. Sreedharan, B.Sc. (Travancore).
Librarian: Miss J. Sanderson, A.L.A.
Field Officer: F. Hawkins.

Central Research Centre, Ilonga

(Private Bag, Kilosa)

Acting Senior Research Officer: D. J. Turner, B.Sc. (Agric.) (Reading), Ph.D. (Edinburgh).
Agricultrual Officer (Irrigation): J. T. Barton, B.Sc. (California).
Agricultural Officer (Experiments): R. A. Haggarty, B.Sc. (London).
Field Officer: I. D. Armstrong.
Field Officer: D. Grieve.
Field Officer: T. Apiyo, Dip.Agric. (E.A.).

The following officers are seconded from the Empire Cotton Growing Corporation:—

Plant Breeder: R. Smith, B.Sc. (Manchester).
Plant Breeder: T. Bradley, B.Sc. (Liverpool).

(a) *Mbozi Experimental Station*

Agricultural Officer: L. M. Rimisho.

(b) *Seatondale Experimental Station*

Agricultural Officer: B. Walker, B.Sc. (Nottingham), Dip.Agric. (Reading), D.T.A. (Trinidad).
Field Officer: G. W. Edwards.
Field Officer on Pyrethrum Research: A. Jenkinson.

Western Research Centre, Ukiriguru

(Private Bag, Mwanza)

Senior Research Officer: T. O. Robson, B.Sc. (Witwatersrand).
Pasture Research Officer: G. D. Scott, B.Sc. (Witwatersrand).

Entomologist: I. A. D. Robertson, B.Sc. (Aberdeen).
Agricultural Chemist: J. Evans, B.Sc. (Wales).
Agricultural Officer (Economics): M. P. Collinson, B.A. (Reading).
Agricultural Officer (Experiments): M. A. Scaife, B.A. (Cambridge), Dip.Agric. (Cambridge), D.T.A. (Trinidad).
Botanist: G. A. Semiti, B.Sc. (Makerere).
Field Officer: F. J. Barrett.
Field Officer: R. Naburi, Dip.Agric. (E.A.).
Field Officer: K. J. Rwiza, Dip.Agric. (E.A.).

The following officers are seconded from the Empire Cotton Growing Corporation:—

Chief Scientific Officer: G. M. Wickens, B.Sc. (Agric.) (Reading), D.I.C., Ph.D. (London).
Plant Breeder: K. J. Brown, B.Sc. (Reading).
Plant Breeder: J. E. Cross, B.Sc. (Wales), M.S. (Minnesota).
Chemist: A. M. Kabaara, B.Sc. (Makerere), M.Sc. (Aberdeen).

(a) *Maruku Experimetal Station*

Agricultural Officer: J. N. Auckland, B.Sc. (Agric.) (Reading).
Field Officer: W. C. M. Maxwell.

(b) *Mwanhala Experimetal Station*

Field Officer: M. R. Naburi.

(c) *Urambo Experimetal Station*

Field Officer: T. Muir.

NORTHERN RESEARCH CENTRE, TENGERU

(P.O. Box 3101, Arusha)

Senior Research Officer: H. J. van Rensburg, M.Sc. (Witwatersrand).
Entomologist: G. Swaine, B.Sc. (Sheffield).
Plant Breeder: B. G. Houston, B.Sc. (Agric.) (Aberdeen), Dip.Agric.Sc. (Cambridge), D.T.A. (Trinidad).
Plant Pathologist: P. K. S. Clinton, B.Sc. (Sheffield).
Plant Pathologist: W. T. H. Peregrine, B.Sc. (Hons.), M.Sc. (Wales).
Plant Pathologist: D. R. W. Watson, B.Sc. (Hons.) (Agric.) (Reading) D.I.A.
Agricultural Chemist: G. D. Anderson, M.Sc. (Agric.), Ph.D. (Durham).
Agricultural Officer (Experiments): J. C. Macarteny, B.Agric.Sc. (Belfast).
Experimetal Officer: B. Simon.
Field Officer: J. W. Packard.

(a) *Horticultural Experimetal Station, Amani*

Agricultural Officer: B. L. Honess, B.Sc. (Reading), D.T.A. (Trinidad).

(b) *Pasture Research Station, Kongwa*

(P.O. Kongwa)

Pasture Research Officer: M. A. Owen, B.Sc. (Agric.) (Wales), Dip.Agric. (Reading), D.T.A. (Trinidad).

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(P.O. Box 43, Nachingwea)

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Entomologist: M. Bigger, B.A. (Trinity College, Dublin) D.T.A. (Trinidad).
Plant Breeder: A. K. Auckland, B.Sc. (Durham), Dip.Agric.Sc. (Cambridge), D.T.A. (Trinidad).

Agricultural Chemist: B. Anderson, M.Sc. (Agric.) (Reading).
Agricultural Officer: P. J. Northwood, B.Sc. (Agric.) (Reading).
Zoologist: H. J. de S. Disney, B.A. (Cambridge).
Experimental Officer: A. Tsakiris, B.Sc. (Poona).
Field Officer: M. J. Simmonds.

COMMODITY STATIONS

(Staff Secondment)

Sisal Research Station, Mlingano

(P.O. Ngomeni)

Financed by Tanganyika Sisal Growers Association

Senior Research Officer: E. C. Diekmahns, B.Sc. (Glasgow), Dip.Agric.Sc. (Cambridge).
Agricultural Officer: D. Hopkinson, B.Sc. (Oxon).

COFFEE RESEARCH STATION, LYAMUNGU

(P.O. Box 3004, Moshi)

Financed by Tanganyika Coffee Board

Principal Scientific Officer: J. B. D. Robinson, B.Sc. (Reading), F.R.I.C.
Entomologist: R. G. Tapley, B.Sc. (London).
Horticulturist: L. M. Fernie.
Plant Pathologist: D. A. Burdekin, B.A. (Cambridge).
Plant Physiologist: R. A. Bull, B.A. (Hons.) (Cambridge), Dip.Agric.Sc. (Cambridge), D.I.C.
Agronomist: H. W. Mitchell, B.Sc. (Agric.) (London), D.T.A. (Trinidad).
Field Officer: J. M. C. Brownbridge, N.D.A., M.B.A.C.

SOIL FERTILITY

A most important aspect of research in crop husbandry is to find methods of at least maintaining soil productivity. While the soil over large areas of the country is of relatively low fertility and is now in poor condition there are tracts of land where the opposite situation prevails. Work at Mwanhala and Urambo (Western Region), Ukiriguru (East Lake Region), Maruku (West Lake Region) and Nachingwea (Southern Region) is concerned with the first circumstance and that at Ilonga (Eastern Region) with the second.

Experiments in low fertility areas are now suggesting that continued application of farmyard manure or fertilizers can more readily effect an actual improvement in soil productivity than had been thought possible.

At Mwanhala, either three tons of farmyard manure or 100 lb. of double superphosphate per acre were applied each year, with 100 lb. of sulphate of ammonia per acre added to the superphosphate when maize was grown. At Ukiriguru either 6 tons of manure or 150 lb. of double superphosphate plus varying amounts of sulphate of ammonia (100–150 lb. per acre) were applied every three years. Cotton, groundnuts and maize were the crops tested. All three crops show quite distinctly that by maintaining a high standard of cultivation and applying fertilizer or manure, either continuously or at regular intervals, it is possible to bring about a marked and steady improvement in soil productivity.

For cotton at Ukiriguru, the mean control yield per annum for nine years was 597 lb. of seed cotton per acre; the responses to manure and fertilizers were 400 and 420 lb. respectively. For maize the mean control yield was 869 lb. and the similar respective responses 1,135 and 1,353 lb. For groundnuts the control yield was 576 lb. per acre of shelled nuts and the responses 276 and 359 lb.

Experiments on the improvement of soil productivity in other areas are not of a suitable design for checking whether continued application of manure or fertilizer results in the striking improvement noted at Ukiriguru and Mwanhala but this is clearly a line that should be followed up.

At Ukiriguru, a permanent experiment has been started to compare the effect of different types of nitrogenous fertilizers, sulphate of ammonia, urea, and calcium ammonium nitrate, on yield of cotton and on soil acidity. Determinations of soil acidity, where sulphate of ammonia has been applied regularly, show an undesirable increase. Sulphate of ammonia applied in the seed bed gave good yield responses from cotton, but better ones, 40–100 per cent, were obtained from a top dressing at flowering time.

Previous work at Maruku had shown that farmyard manure, nitrogen, potash and perhaps lime were valuable for increasing yields of arable crops. Two new experiments were started this year. With maize and sorghum, manure alone and with sulpahte of ammonia, gave good responses.

TABLE 1

THE EFFECT OF MANURE AT 3 TONS PER ACRE AND SULPHATE OF AMMONIA AT 1 AND 2 CWT. PER ACRE ON YIELDS OF MAIZE AND SORGHUM (LB. PER ACRE) AT MARUKU

	Maize (MAR 34A)	Sorghum (MAR 34B)
Nil	1,008	78
Response to manure alone	+ 613	+190
Response to manure+1 cwt. S/A ...	+1,198	+294
Response to manure+2 cwt. S/A ...	+1,611	+416

Table 1 shows that maize gave high responses but sorghum rather poor ones. With both crops the manure response is not significantly better than control but the other two treatments are (maize P=0·01 and sorghum P=0·05).

Two further experiments (MAR. 35A, B) studied only inorganic fertilizers; sulphate of ammonia, limestone and muriate of potash. With maize, only potash (60 lb. K_20 per acre) gave a significant (P=0·01) response (842 lb. per acre on a control yield of 1,216 lb.). Sorghum grew poorly, the mean yield without potash being 79 lb. per acre and with potash 247 lb.

At Urambo, three tons of farmyard manure applied annually gave a response of 650 lb. of maize and 230 lb. of soya beans. Groundnuts, as in previous years, did not give any increased yield. Fertilizers did not give any increase in yield of groundnuts or soya and only a small one, 380 lb. per acre, for maize (URB. 1).

At Mwanhala, the residual effect of phosphate on the soil type is particularly long lasting. In the fourth residual year, 100 and 200 lb. of double superphosphate applied in 1957 raised yields of maize by 291 lb. and 847 lb. per acre respectively (MWA. 1). This long continued residual effect is at least a partial explanation of the build up in soil condition noted when fertilizers are applied annually. Excellent yields of maize and groundnuts were obtained in experiment MWA. 2 in its fourth year. Table 2 gives the results. In this year the alternate application treatments were residuals.

TABLE 2

RESPONSES FROM CONTINUOUS AND ALTERNATE APPLICATIONS OF MANURE AND FERTILIZERS (LB. PER ACRE) AT MWANHALA

	Maize	Groundnuts
Control	709	700
6 tons manure every year	+3,173	+1,111
3 tons manure every year	+2,492	+ 634
6 tons manure alternate years	+1,804	+ 507
3 tons manure alternate years	+ 793	+ 242
Fertilizer every year	+2,365	+ 847
Fertilizer alternate years	+1,664	+ 493

Experiment MWA. 3 was designed to measure the residual effects of three years continued application of manure and fertilizers.

TABLE 3

RESPONSES FROM THE RESIDUALS OF THREE YEARS CONTINUOUS APPLICATION OF FERTILIZER AND MANURE AND FOUR YEARS CONTINUED APPLICATION (LB. PER ACRE) AT MWANHALA

	Maize		Groundnuts	
	Continued Application	Residual	Continued Application	Residual
Control	744		470	
3 ton manure ...	+1,264	... +1,129	... +354	... +239
Fertilizer	+1,031	... + 660	... +425	... +369
Both	+2,158	... +1,671	... +428	... +332

It can be seen that residual responses are appreciable but they tend to be lower than responses to the fourth application.

Minjingu phosphate applied (at Mwanhala) in 1959 at 500 lb. per acre and in 1960 at 300 lb. per acre gave very high residual responses, with maize 1,333 and 1,003 lb., and with groundnuts, 928 and 723 lb. per acre. One hundred lb. of double superphosphate applied in 1959 gave residual responses of 638 and 232 lb. for maize and groundnuts respectively. It has been mentioned above that superphosphate has given residual responses for four years after application and it would seem reasonable to expect good residual responses from the Minjingu phosphate for at least a similar period. First indications are that Minjingu phosphate will prove very valuable in this area if it can be distributed cheaply.

At Nachingwea, the results from the soil fertility programme are in line with those previously recorded. Yields of soya beans were not affected by various methods of stover disposal, including removal and ploughing under. Minjingu phosphate and superphosphate applied in 1960 increased maize yields by 1,373 lb. and 1,425 lb. per acre respectively but groundnuts showed no increase to either. First and second year applications of both fertilizers gave increased yields of maize of the same order and 200 lb. of groundnuts per acre.

Continuous application of farmyard manure over four years has given increased responses with maize and soya beans but not groundnuts. Responses to continued applications of fertilizer have remained constant for the three crops. Responses by maize, groundnuts, sesame and soya beans to either farmyard manure or the ash of an equivalent amount do not show any differences.

At Ilonga, however, with higher basic fertility, soil condition is still good. An experiment started in 1960, with cotton and maize in rotation, is measuring responses from farmyard manure (5 tons per acre) or fertilizer (1 cwt. double [42 per cent] superphosphate plus 1 cwt. sulphate of ammonia per acre), applied annually, in odd years and in even years. 1961 data are given in Table 4.

TABLE 4

MEAN YIELDS FROM VARYING METHODS OF APPLYING MANURE AND FERTILIZER AT ILONGA

Treatments	Maize grain lb. per acre	Seed Cotton lb. per acre
Control	... 3,481	... 1,135
Manure every year	... 3,453	... 1,183
Manure in 1961	... 3,365	... 1,129
Manure in 1960	... 3,485	... 1,312
Fertilizer every year	... 3,725	... 1,092
Fertilizer in 1961	... 3,384	... 1,215
Fertilizer in 1960	... 3,433	... 1,129

A cotton experiment at Majaliwa, near Ilonga, gave the results given in Table 5.

TABLE 5

MEAN YIELDS OF SEED COTTON FROM VARYING METHODS OF APPLYING MANURE AND FERTILIZER AT MAJALIWA

Treatment	Yields
Control	717
Manure 1960	623
Manure 1960 and 1961	706
Manure 1961	780
Fertilizer 1960	853
Fertilizer 1960 and 1961	842
Fertilizer 1961	778

The terms manure and fertilizer in Table 5 have the same meaning as in Table 4. The data in Table 4 and 5 illustrate the point made at the beginning of this section.

ENTOMOLOGY

THE CONTROL OF TERMITE AND FLEA BEETLE DAMAGE BY INSECTICIDES

Nearly all annual crops grown at Nachingwea suffer damage from termites. Sunflower is badly attacked, maize and soya bean suffer fairly considerable damage and sesame somewhat less while groundnuts are scarcely affected. The severity of attack varies from year to year, apparently according to prevailing rainfall conditions and soil type. The main species of termite causing damage are *Odontotermes latinstus* and *O. zambesiensis*. *Microtermes* spp. are also present.

Early work by the Overseas Food Corporation, using D.D.T. and B.H.C., suggested that some control could be effected by soil applications. With the development of more suitable insecticides, such as aldrin and dieldrin, this work has been followed up using either direct soil application in bands, or seed dressings.

In the first year, 1959, it was found that 2 lb. per acre active ingredient of aldrin applied directly to the soil gave virtually complete freedom from termite damage while seed dressings gave partial control. Soya and sesame gave useful increases in yield but variation in soil fertility in the maize and sunflower experiments was too high for reliable results to be obtained.

In 1960, rather lower concentrations of aldrin were used on maize and soya. During this year a more even distribution of rainfall led to an absence of the extensive drought periods experienced in 1959 and plant losses were much lower. But in a number of cases increases in plant populations were recorded from seed dressings, applications of insecticide to the ridge and from residual effects of ridge applications made in 1959. Useful increases in yield were shown by maize and sunflower to seed dressings and by maize to residual effects from 1959 applications but soya bean yields were not increased.

The 1961 experiments were designed to obtain greater accuracy and the number of treatments was reduced to a minimum, based on the assumption that a ridge application of 1 lb. of active ingredient per acre of aldrin was adequate for control. Further seed dressing experiments were carried out using dressings containing higher concentrations of dieldrin. Dressing B contained 75 per cent dieldrin and C 60 per cent dieldrin together with a fungicide. Rates of ¼ and ½ oz. per lb. of seed were used.

Aldrin at 1 lb. per acre active ingredient in the ridge gave increased plant populations for maize and soya at both emergence and harvest, but no increase in yield. Sesame gave increased populations and an increase in yield, from 17 lb. per acre to 64 lb. per acre; these results were probably a combination of protection from both flea beetle and termite damage. Seed dressings Dieldrex B and C gave very large increases in plant populations and useful increases in yield of soya beans.

These dressings also showed good control of flea beetle attack on sesame during the first month after emergence. Dieldrin as a foliar spray gave good control of flea beetle, increasing harvest populations by six times and yield by seven times, i.e., from 40 to 280 lb. per acre.

This promising line of work is continuing.

Control of Army Worm

The pattern of spread was south to north in the early part of the year but a local outbreak also occurred in the Arusha District during the abnormally heavy first rains at the end of the year.

Preliminary trials at Tengeru suggest that row spraying of young cereals will effect adequate control more cheaply than spraying the whole area. It is considered that a swathe of about six inches wide should be treated.

The general problem of this pest is to receive more attention. An entomologist from the Commonwealth Bureau of Entomology has carried out a review of literature and all outbreaks in Tanganyika are to be reported to the Entomologist, Tengeru. A mercury vapour light trap has been installed at Tengeru to study population changes of the moths and similar traps are to be placed at the other three Research Centres.

INTERCROPPING

At Ilonga castor was intercropped at early and late plantings in early planted maize, sesame and groundnuts. Very low plant populations were established at the late plantings and yields were negligible. When both crops were planted early, higher production was obtained of both crops from one acre of intercrop than from half an acre of each. Table 6 shows the results.

TABLE 6

Production (in Lb.) from Pure Stands and Intercrops at Same Date of Planting using Different Crop Combinations

	Castor	Maize	Sesame	Groundnuts
Pure Stands				
½ acre production	132	1,708	124	498
Intercropping				
1 acre production	253	2,947	—	—
	194	—	172	—
	462	—	—	709

At Wami, a maize and sesame experiment showed the value of intercropping as an "insurance" against the loss of one crop. At the early planting the maize was destroyed by rats and army worm, and at the late planting it was devastated by pigs. The results are shown in Table 7.

TABLE 7

Sesame Yields when Maize Yields were lost from Natural Hazards (Lb.) at Wami

	Time of planting (sesame)	
	Early	Late
Pure Stand		
½ acre production	231	148
Intercropping (½ acre)		
Early sesame, early maize	302	
Early sesame, late maize	320	
Late sesame, early maize		275
Late sesame, late maize		246

The value of intercropping in such circumstances is clearly shown.

A similar experiment was carried out at Duthumi, intercropping maize with two varieties of sesame at two dates of planting. Early planted maize in pure stand was damaged by pig but when intercropped with late planted sesame the pig appeared to have been deterred by the dense growth of sesame. Growth of early maize in early sesame was poor and most of the plants died before harvest time; those that did survive did not produce cobs. Late maize planted in early sesame germinated but the plants died after a few days. The data are given in Table 8.

TABLE 8

PRODUCTION OF MAIZE AND SESAME INTERCROPPED AT EARLY AND LATE DATES OF PLANTING (LB.) AT DUTHUMI

	Planting dates					
	14th January			1st March		
Pure Stands	Maize	Local Sesame	Morada Sesame	Maize	Local Sesame	Morada Sesame
½ acre yields	392	365	176	402	293	152
Intercropping (1 acre)						
Early maize, early sesame	0	697	282	—	—	—
Early maize, late sesame	908	—	—	—	473	232
Late maize, early sesame	—	695	370	0	—	—
Late maize, late sesame	—	—	—	480	495	241

Intercropping early or late maize in late planted sesame gives increased production of both crops. The combinations early or late maize with early sesame were clearly valueless in that particular season.

INVESTIGATIONS OF LOCAL INTEREST

In West Lake Region a number of trials and experiments were carried out at Kituntu and Kaibanja on a range of crops.

At Kituntu, wheat gave better yields on the flat than on the ridge, due to higher populations, and of the five varieties tested only one, Frontana x K58 Newchatch, yielded well, giving 1,200 lb. per acre on the flat. Mwitunde groundnuts gave better yields than Local and Natal Common; 478, 146 and 114 lb. per acre respectively. The two latter varieties were severely infected by rosette disease. Soya beans in one trial gave a low mean yield of 648 lb. per acre, with Hernon Nachingwea the highest at 839 lb. and Local the lowest at 468 lb. In another trial some Nachingwea strains gave very promising yields of 1,300–1,500 lb. per acre. Special varieties of haricot beans also yielded well but not better than local mixed and haricot beans. Irish potatoes gave highest yields from October–November plantings on the ridge (7,310 lb. per acre).

At Kaibanja, yields of most crops were low and future work will be carried out on a new site less liable to waterlogging.

In the Eastern Region, rainfall at Wami was 11 in. below the average of 26·4 in. and most experiments were damaged by rats, army worm and pig. These misfortunes resulted in a considerable loss of information, particularly in the time-of-planting experiments. Such results as were obtained merely showed that late plantings (March) of all crops gave lower yields. Local sesame yielded well from plantings in February (800 lb. per acre). Katumbili maize gave much higher yields (2,000 lb. per acre) than the short term M6 and M31 (700 lb. per acre).

At Duthumi, rainfall was higher than the average, particularly in February and April. In contrast to Wami, most of the experiments were carried through successfully and good yields were recorded. Local sesame outyielded Morada at several different dates of planting, the margin being greatest at the earliest date. Katumbili maize gave higher yields than M6 and M31. Six varieties of sesame were compared at two dates of planting and the Local variety was the best, significantly ($P=0{\cdot}01$) outyielding Morada at both dates.

At Suluti, near Songea, local varieties of groundnuts and maize gave good yields, as high as those of introduced varieties, but Morada sesame outyielded Local sesame. Nachingwea soya bean varieties gave high yields, 1,500–1,600 lb. per acre.

At Mtopwa, phosphate (36 lb. P_2O_5 per acre) and potash (60 lb. K_2O per acre) did not increase yields of maize and nitrogen (40 lb. N per acre) only gave a response of about 150 lb. on a low control yield of 650 lb. per acre. Similar yields and responses

were recorded in the fallow experiment. In a series of experiments comparing flat and ridge planting at three dates of planting all crops except sorghum gave higher yields for flat planting, even though plant populations were similar. But the general yield levels were poor. One experiment compared various shapes and sizes of ridge for hill rice. In this year of low rainfall the flat planting well outyielded the ridge plantings, which varied little between themselves.

The traditional system of land use, i.e., slashing followed by burning and leaving stumps *in situ* was compared with slashing, burning and stumping with and without fertilizer and clean weeding or limited weeding. Only stumping had any effect on yields of hill rice, reducing the mean yield per acre of no stumping from 430 lb. to 315 lb. per acre. This was the first year of a long-term experiment.

The traditional method of intercropping first year land was compared with pure stands of the five crops planted and an equivalent area of land planted with alternating sets of single rows of each crop. Some of the data are given in Table 9.

TABLE 9

YIELDS (LB. PER ACRE) AND PLANT POPULATIONS ('000 PER ACRE) FROM THREE METHODS OF CROPPING AT MTOPWA

Crop	Traditional		Pure Stands		Alternate rows	
	Yield	Pop.	Yield	Pop.	Yield	Pop.
Maize	74	1·5	112	2·8	120	1·2
Rice	548	41·8	102	8·5	114	4·1
Millet	201	1·3	100	1·8	223	1·4
Cowpea	Nil	·4	19	3·4	Nil	1·0
Sesame	1	4·6	90	4·4	57	2·6
Total	824		423		514	

The traditional method provided the greatest production per acre. An examination of the plant populations achieved suggests that the traditional method is essentially the intercropping of four other crops in a field of rice. The higher yields of sesame and cowpea achieved in the non-traditional methods were achieved only by the use of insecticide for pest control. Without this treatment the area under these crops would have been unproductive.

At Mbulu in the Northern Region an unreplicated demonstration plot showed that cotton planted on the ridge and dusted gave more than double the yield of seed cotton obtained from planting on the flat without dusting.

A fertilizer experiment in the Kiru Valley (Northern Region) indicated that seed beans may respond to phosphate.

IRRIGATION

Water infiltration studies were continued at Kalimawe, Tanga Region. Four infiltrometers were used for direct field measurement. The findings confirmed those previously obtained in laboratory studies. Infiltration rates varied widely according to soil type. Applications of gypsum (2 tons ground material per acre) to a dry soil markedly improved percolation and increased the rate of removal of soluble salts and exchangeable sodium. But these effects did not obtain when gypsum was puddled into a wet soil. It is suggested that certain physical methods and the use of sulphate of ammonia will effect gradual improvement of these soils but gypsum can be very useful when more rapid amelioration is needed.

At Uru-Chini soil moisture blocks were used to follow the pattern of water use under lucerne, cotton, onions and garlic. Results followed the expected pattern and yields were good.

METHODS OF CULTIVATION

In the Northern Region trials were continued with N.I.A.E. designed tropical cultivation equipment. In the absence of trash the machine worked well and the

ripping tines gave an encouraging performance; only failing to work under the most unfavourable conditions. Very promising control was obtained of post germination weed growth.

Moisture readings on red soil provided clear evidence of greater water penetration under tie-ridging than under ridging and, particularly, under flat cultivation. The figures on the heavier black soil were not so clear but there was clearly decreasing run-off from tie-ridged land.

SEED TESTING

Consequent upon Tanganyika joining the International Seed Testing Association on January 1st 1962, the Pathology Laboratory at Tengeru will become an officially appointed Seed Testing Station. Legislation making it an offence to plant a seed crop with seed which has not been tested and certified, will be introduced early in 1962.

There was an increase in the number of seed samples submitted for testing. A total of 6,839 bags were sampled. There was also an increase in the testing of seed beans for export. Testing of seed pea samples from Southern Highlands Region also continued.

SOIL STUDIES

The reconnaissance survey of Bondei in the Eastern Usumbara foothills was completed. The acquisition of aerial photographs will enable the early completion of the report.

A number of profiles have been examined and analyses carried out upon soils from land use schemes.

A preliminary investigation has disclosed an apparently substantial belt of very acid soils at an altitude of 4,500 to 6,000 feet on the southern and eastern slopes of Kilimanjaro.

TRIAL MANAGEMENT FARMS

At Ilonga in the first year, three acres of land were cleared from grass and light bush and one acre each of maize, groundnuts and cotton grown. The essential information is given below.

TABLE 10

RECORDS FROM ILONGA TRIAL MANAGEMENT FARM

	Maize	Groundnuts	Cotton
Yield (lb.)	1,953	460	A 944 B 294
Cash value	358/-	278/-	602/-
Hired labour days	36·3	65·3	112·3
Family labour days	64·0	75·0	145·0
Total labour, No. of hours	545	743	1,603
Expenditure on labour	67/40	109/10	154/30
Other expenditure	10/60	14/-	80/-
Net profit	280/-	152/90	367/70

The cotton yield was good but maize and groundnut yields rather low. The amount of time spent in cultivating and harvesting each crop is very high. A "day" for maize and groundnuts approximated to 5 hours and for cotton 6 hours.

In relation to both cash expenditure and labour input maize was the most profitable crop, followed by cotton.

WEED CONTROL

In continuation of earlier work five herbicides (Na MCPB, Ipazine, Ametryne, Atratone and Tetazine) were used in a logarithmic trial on seed beans. With haricot beans Na MCPB, Ametryne, Ipatone Prometryne, Weedobon and G34360 were used. Present recommendations are for the use of Na MCPB at 2–3 lb. per acre.

CROPS

Bananas

Agronomy.

At Maruku, a plant population of 100 stools per acre is not sufficient for high yields, but there were no significant differences between the yields of 200 and 400 stools per acre (3,870 lb. and 3,970 lb. per acre respectively). The bunch size was larger at 200 stools per acre.

Cultivation treatments had big effects on yield in the presence and absence of nitrogen; mulching being particularly effective in increasing yields.

TABLE 11

Yields of Bananas (First Crop) as Affected by Cultivation Treatments (Lb. per Acre)

Cultivation	No nitrogen	Nitrogen
Clean-weeded	600 ...	346
Weeds slashed	1,318 ...	650
Beans interplanted	1,513 ...	1,678
Thin mulch	2,098 ...	3,719
Thick mulch	4,673 ...	4,491
Alternate rows mulched	3,656 ...	4,871

Table 11 shows that nitrogen was most effective in the presence of thin mulch or where mulch was applied in alternate rows.

In the establishment trial, planted in 1959, only the suckers planted with manure have given good yields. Generally a complete mulch has led to earlier bearing than bare soil. A large initial sucker was also important in producing a high yield.

Plant Breeding and Selection.

A collection of banana varieties is being built up in a search for an improvement on the present local type.

Cashew

Agronomy.

At Nachingwea, air layers started in early November were ready for planting out in about two months time and so could be established fairly early in the rainy season. Eighty per cent of layers established at this time rooted. Some of the layers planted out last year are growing well and are more advanced than seedling trees of the same age.

Studies were made of floral morphology and showed considerable variation in staminal arrangement in both male and hermaphrodite flowers. Most of the flowers open between 8.30 a.m. and 2.30 p.m. with a peak period between 11.00 a.m. and noon.

Bagged inflorescences do not produce any nuts and it seems clear that pollination is normally done by insects. The efficiency of natural pollination seems as high as that achieved by hand and it is unlikely that pollination is a factor normally limiting yield. Care may have to be exercised over the application of insecticides during the flowering period.

In a fertilizer experiment no growth responses were obtained in the second year. But root distribution was still mainly confined to the planting hole, which had been filled with topsoil. Farmyard manure, applied as a mulch, has however, given an increase in growth in another experiment. Intercropping with soya beans has not reduced the growth of cashew and yielded 500 lb. of seed per acre.

The depth of free draining soil has a strong effect on growth during the first two years of life. Where the depth is 36 inches or more, growth and flowering are vigorous, with 24 inches or less growth is poor and flowering poor or absent.

Cashew seeded with Rhodes grass, which was later grazed, suffered severe damage. A 92 per cent stand was established but this was reduced to 23 per cent after a few grazings. The remaining plants were so damaged that it is doubtful if they will grow into good trees.

Trees planted in January, 1959, from varying specific gravity weights of seed were again recorded during the year. Mean nut yields per tree increased steadily with increasing specific gravity of the original seed, from 3·89 lb. (S.G. <1·00) to 6·29 lb. (S.G. <1·075). These figures are means of 35 and 26 trees respectively. Trees from the denser nuts also maintained their girth advantage.

Further study of a number of foreign cashew lines again showed the local Tanganyika and two types from Ceylon to be the highest yielders. The data are from observation lines of about thirty trees.

Further work with arboricide has confirmed the effectiveness of a mixture of 2-4 D and 2-4-5 T diluted with diesoline. The cost of materials was 20–25 cents per tree.

Plant Protection.

Pseudotheraptus Wayi causes spotted kernels. A survey of the cashew growing areas of the Southern Region showed the proportion of spotted nuts to be over 5 per cent in most areas, and much higher than this in some. Current measures against Helopeltis do not control *P. Wayi* and spraying at flowering may be necessary to control it. This will pose some difficulties.

A die-back effect in the Southern Region was further investigated. Vascular distortion of root tissues was always present and a number of fungus isolates have been made for identification. Infections appear confined to old plantations where management standards are poor.

Cassava

Agronomy.

At Ukiriguru clone 46106/26 yielded 6·6 tons of fresh tubers per acre, about 1·5 tons higher than the present recommended varieties. Yields of this order give a return of about Shs. 250/- per acre per annum.

Cocoa

Agronomy.

Following a detailed survey of the Maramba Estate, Tanga Region, it was recommended that 23 per cent of the area was immediately suitable for cocoa production. Most of this is already planted to the crop.

A two-level factorial experiment using lime, nitrogen phosphate and potash has been laid down on the estate.

Initial girth and height measurements of fertilized trees at Bondei have been made.

Plant Protection.

There were no reports of serious disease infection. Some occasional root infections were tentatively diagnosed as due to *Ustulina* spp.

Coconuts

Plant Protection.

The premature nut fall, proviously noted, is apparently confined to on eestate near Tanga. A survey showed slightly under 6 per cent of the trees to be infected.

Coffee

Arabica

Agronomy.

At Mitalula, Rungwe District, the variety and mulch experiment produced its first crop, a number of varieties producing over 4 cwt. per acre. Mulching gave

increases in yield but these were not significant. In the fertilizer experiment the treatments had no outstanding effects. Where bananas were interplanted the number of coffee trees was reduced but the reductions in yield were much greater than would be accounted for by the lower number of trees.

TABLE 12

YIELDS OF INTERPLANTED COFFEE AND BANANAS COMPARED WITH COFFEE ALONE, AT MITALULA

Treatments		Yields			
		Coffee		Banana	
Coffee per cent	Bananas per cent	cwt. per acre	lb. per tree	tree per acre	bunches per clump
100	Nil	5·3	1·10	—	—
75	25 mixed irregularly	1·0	·28	567	4·8
64	36 in four square	1·6	·51	643	2·4
50	50 mixed irregularly	·8	·35	486	2·1
50	50 in alternate lines	·7	·31	486	1·8

At Mbozi, Mbeya District, the work on zinc and boron has stopped. A critica examination of the results has not revealed any beneficial effect. Copper spraying gave increased leaf retention and a very striking mean increase in yield of 4·1 cwt. per acre on a control yield of 0·3 cwt. Hedge coffee continued to yield well. The following are the yields per acre to date in cwt. of clean coffee.

TABLE 13

FOUR YEARS YIELDS FROM HEDGE COFFEE AT MBOZI

	1958	1959	1960	1961
Planted 1956	1·06	4·31	16·83	9·38
Planted 1957	—	1·72	13·80	13·08

The yields in 1960 and 1961 are considerably higher than those from most other experiments.

Irrigation trials and experiments gave disappointing results; irrigation usually depressed yields.

COFFEE

Robusta

Agronomy.

At Maruku, the effects of lime and manure applied at planting in 1956 in the establishment trial (MAR. 5) are now very small. The effects of fertilizer applications are somewhat variable. Fertilizers in the absence of manure or lime gave no responses, in the presence of manure some useful increases in yield were recorded. Interplanting bananas in both *Robusta* and *Arabica* coffee reduced yields considerably, by 60 per cent even when only 100 stools were present. The coffee had no effect on banana production. Nitrogenous fertilizer increased yields appreciably over a series of cultivation treatments by 40 per cent, responses were least in the presence of thick mulch and alternate row mulch.

COTTON

Agronomy.

Previous experiments at Ukiriguru have not shown any differences between ridges spaced at 3 and 5 feet, the advantage of the former being that it can be more easily made by ox or tractor drawn implements. This year, one of the new Albar varieties gave an appreciably increased yield of 400 lb. of seed cotton per acre on the 5 feet ridges whereas no difference was shown by Uk 55.

Cessation of vegetative growth usually coincides with the formation of the first bolls. Early flowers were removed for 10 days and for 20 days to try to prolong the period of vegetative growth and produce an increase in yield. The results were startling. Plants from which flowers were not removed gave 1,205 lb. per acre,

removal of flowers for 10 and 20 days gave increases in yield of 447 and 1,231 lb. per acre respectively. Rainfall for the months March–April was approximately equal to the 30 year average. The increased yield was mainly obtained through a greatly increased boll size.

At the Mbarali trial farm, Mbeya District, yields ranged from 1,805 lb. seed cotton per acre for a December planting down to 590 lb. for a January planting. The cotton was mainly rain grown with only one irrigation during a dry period in March.

Plant Breeding and Selection.

Testing of the three main families from the Albar hybrid breeding programme was continued at Ukiriguru. For the wetter areas of the north Lake Region, re-selections from the UkA G 2.1 family appear to be promising; particularly for their resistance to bacterial blight. Resistance to bacterial boll rot is especially important and may substantially increase yield in the wetter years. The lint is slightly longer and finer than the present types.

For the drier conditions of the south the two families, UkA 67 and UkA 121, offer the best hope of improvement. Seed cotton yields are generally higher than Uk 58 and ginning percentages are considerably higher—some lines showing increases of around 2 per cent.

At Ilonga, stocks of a number of different cottons have been built up during the past five years. These stocks contain better jassid and bacterial blight resistance than local material and they will be incorporated into the revised breeding programme.

Albar varieties from Ukiriguru and UPA from Namulonge (Uganda) gave very considerable increases in yield over IL. 58, the UPA selections have a better habit and would appear to be more suitable for the Eastern Region. Other introduced varieties from Ukiriguru and Uganda gave appreciably higher yields than IL.58. Ginning out-turn and jassid resistance were much better in the introduced varieties. Spinning tests on a number of these newer varieties showed qualities approximating to those required for accepted "Eastern Region" standards, as exemplified by IL. 58.

Tests on seeds from thirteen ginnery zones in Eastern Region showed again that no deterioration had occurred due to local selection pressure. In the district trials a number of new strains gave higher yields than IL. 58. A strain from Ukiriguru and UPA from Uganda being outstanding, with respective increases of 25 and 29 per cent over IL. 58.

Plant Protection.

The annual survey of *Fusarium* wilt in Lake Region showed that the disease is steadily increasing in severity and that the infection is spreading. It has been discovered, for the first time, on Ukerewe Island but has probably been there for the past 2 or 3 years. It has also been found near the Lake shore some 35 miles east of any other known infection and up to about 10 miles inland from the Lake in Geita District. It is clear that prohibition of seed movement from infected areas has prevented a much greater spread of the disease.

Infection tends to be more severe both where cotton has been continuously cultivated for long periods and in the presence of root-knot nematodes.

There has been a serious increase in the Pink-bollworm population in Lake Region; probably due to some relaxation in the enforcement of rules governing uprooting and burning. Although there was little loss in yield this year, owing to a late build up of the pest, the carry-over in unharvested bolls may result in a heavy attack next year.

Increases in yield and quality were obtained in insecticide experiments but the profit margins were very slight.

A pest survey was carried out in the Kigoma area where cotton is a recently introduced crop. Stainers (*Dysdercus* spp.) were the most important pest followed by *Calidea dregii*. *Helopeltis* spp. caused appreciable damage at Simbo. Bollworms were not serious. Spraying with 1 lb. D.D.T. per acre per week was not effective in controlling stainers and *Calidea*.

In the Eastern Region use of insecticides gave striking results.

TABLE 14

MEAN YIELDS OF LINT (LB. PER ACRE) FROM VARIOUS PLOTS IN THE EASTERN REGION

	Ilonga	Kisaki	Mikese	Deozile	Turiani
Sprayed	728	249	333	148	293
Unsprayed	106	15	26	9	59

It was calculated that increases greater than 60 lb. lint per acre were economic. Even greater responses were shown by the unreplicated demonstration plot at Ilonga which also included a late planting treatment.

TABLE 15

YIELDS OF SEED COTTON (LB. PER ACRE) FROM ILONGA DEMONSTRATION PLOT

Treatment	Yield
February planted—sprayed	1,332
February planted—unsprayed	96
February planted—unsprayed and badly cultivated ...	36
March planted—unsprayed	Nil

A survey of bacterial blight infection in the Eastern Region showed a generally low infection except at and around Ilonga. The latter is a likely consequence of the adoption in recent years of a February planting regime and is of importance as an indication of what may happen as a result of early planting being more widely adopted.

A drive by the Extension Division, assisted by the Social Development Department, to encourage better cultural methods and use of insecticide met with considerable success at Ulaya and Kisaki. The concentrated energetic approach gave an indication of achieving results for which we have been striving over several years.

GROUNDNUTS

Agronomy.

Observation suggested that a high proportion of pegs failed to penetrate normal 3 feet ridges at Ukiriguru. But an experiment comparing normal and flat-topped ridges detected no differences in yield. Natal Common and Asyria Mwitunde were compared at a number of stations in Lake Region for three years and Natal Common outyielded Mwitunde by about 200 lb. per acre of unshelled nuts. Highest yields were produced from early plantings in the case of both varieties. It can now be recommended that good yields will be obtained from Natal Common, closely spaced (around 60,000 plants per acre), planted in early December.

Nine varieties, assessed as very suitable for confectionery nuts, were compared with Natal Common at Ilonga. All yielded well—1,059–1,415 lb. of kernels per acre and compared favourably with Natal Common. As in 1960 there were no significant differences between varieties, though one gave a rather higher yield at the mid-March planting.

Breeding and Selection.

At Nachingwea some promising lines were obtained in the search for a variety having resistance to rosette but with pale-skinned kernels.

Plant Protection.

Use of systemic insecticide sprays to control rosette disease at Urambo raised yields by about 200 lb. per acre but this level of increase is not economic. One of the compounds was also used as a seed dressing at 4 per cent of the seed weight and gave a yield increase of 250 lb. This simpler and cheaper method appears promising for those areas growing confectionery type groundnuts where rosette is troublesome but not sufficiently severe to justify growing the variety Asyria Mwitunde.

Haricot Beans

Agronomy.

Eighteen varieties selected for performance and rust resistance in 1960 were planted for bulking. The best variety was bulked again in the short rains but became rust infected. Subsequently this infection was found due to a third race of rust (designated C). It is now apparent that only six of the varieties have remained resistant to all three races.

Hibiscus

Agronomy.

The variety Laos failed at Lumemo due to a severe attack of a fungus, *Fusarium* sp. This disease also attacked the varieties Cuban and ECR 985/6. The Cuban variety gave low yields of fibre at all dates of planting. ECR 985/6 gave a high yield (1,890 lb. of fibre per acre) at close spacing (12 in.×9 in.) planted on 25th February, though the yield for a planting three weeks later was 250 lb.

Two observation plots at Mlali produced 1,654 lb. and 1,486 lb. of fibre per acre from spacings of 8 in.×2 in. and 8 in.×4 in. respectively. Both were planted on March 3rd and received no irrigation, though there was some seepage.

Plant Breeding and Selection.

At Tengeru further selection took place from a multi-cross block of ECR 985/986.

Maize

Agronomy.

At Urambo, maize grown after fertilized tobacco showed no residual responses when not top-dressed with nitrogen. When sulphate of ammonia was re-applied to the appropriate plots yield increases of 1,000–1,300 lb. of maize were recorded from the nitrogen and there was evidence of small response from the residual phosphate.

During the period 1958–61, twelve maize varieties, including the short term M6 and M31, have been tested at Tarime and Ukiriguru but none was consistently better than Katumbili.

At Ilonga, maize spaced at 9 inches in the row gave 500 lb. per acre more than 18 inches in the row, averaged over six varieties. The short-term variety M6 gave yields equal to the two Katambili varieties at similar plant populations. Also at Ilonga there was a significant ($P=0{\cdot}05$) interaction between date of planting and spacing. Yields at 3 ft.×1 ft. dropped more sharply with later planting than these at 3 ft.×2 ft. Soil moisture studies suggested that this factor may be at least partly responsible for the drop in yields.

In the Northern Region four unreplicated demonstration plots grown on old shambas, according to local methods, showed responses varying from 1 to 3 bags (of 200 lb.) an acre to 5 tons of dung. This was on a basic average yield of 4 bags per acre.

Plant Breeding and Selection.

At Tengeru final selections were made for the proposed synthetics. A wide range of material has been included. The varieties M31 and M6 have been withdrawn from general cultivation to undergo a programme of reselection.

Pasture

The grazing management trial at Ukiriguru on the Itogoro (hard-pan) soil type, showed little difference in live weight gain between continuous and rotational grazing. Using beef animals, gains were 179 and 154 lb. respectively over a period of 68 weeks. During the period November to July the mean daily gain in weight was higher on Rhodes grass than on natural grazing, 1·16 and 1·00 lb. respectively. Yields of dry grass on this hard-pan soil are about 600 lb. per acre. This figure is the total yield of three cuts made between the start of the growing season and the end of September. Although the quantity is low, quality must be high as these pastures can carry a beast per two and a half acres.

Cenchrus ciliaries, *Chloris gayana* and *Panicum maximum* alone and mixed were established under maize in 1959. They have maintained themselves well under heavy grazing. A number of new strains of grasses were introduced and some appear to be promising. Of the many grazing legumes tested only two, velvet bean and *Calapogonium orthocarpum*, appeared to be promising. Lucerne and *Glycine javanica* have persisted well in a Rhodes grass pasture. It is now generally recommended that lucerne (at 1 lb. per acre) should be sown with Rhodes grass. Trials continue with mixtures of Rhodes grass and other legumes.

Plant Breeding and Selection.

At Tengeru some very promising Rhodes grass single plant selections have been obtained from the three hundred and eighty originally planted in 1959. They are now being reproduced vegetatively for further testing.

Pyrethrum

Agronomy.

Interim results from some of the agronomic experiments conducted on private farms are now available though complete data will not be known until 1963 or 1964 when the full cycle is completed.

The 120 series of experiments is investigating the effects of lime, nitrogen, phosphate and potash at four sites. Treatments are: Lime, Igawa limestone (40 per cent CaO, 3 per cent MgO) 50 cwt. per acre; Nitrogen, sulphate of ammonia 200 lb. per acre; Phosphate, double superphosphate (42 per cent P_2O_5) 200 lb. per acre; Potash, muriate of potash 200 lb. per acre. Table 16 gives the mean yields from the four sites.

TABLE 16

Mean Yields (Lb. dried Flowers per Acre) from Four Sites for Varying Fertilizer Treatments

Treatment	Yields
Control	169
Complete fertilizer	251
Complete plus 400 lb. superphosphate	255
Complete less nitrogen	226
Complete less phosphate	230
Complete less potash	227
Complete less lime	234

All treatments significantly (P=0·01) outyielded the control but did not significantly differ between themselves.

In the 120 series of experiments superphosphate was better than either Uganda rock phosphate or Minjingu phosphate but the difference was not significant, as it had been in 1960. There was a tendency, particularly with superphosphate, for placement in the planting hole to be better than an application under the ridge. All the treatments in the series were applied in the year of planting only.

Rotation experiments have not given any definite trends and no previous cropping treatment has yet had any large effect on the following pyrethrum crop. In fact, we have not yet been able to obtain yields from plantings on old pyrethrum land to approach those which come from newly cleared forest soils.

Table 17 gives the results from an irrigation experiment carried out on a first year crop on a private farm.

TABLE 17

Mean Yields of Dried Pyrethrum Flowers (Lb. per Acre) from Three Irrigation Treatments

Treatment	Yields
No extra water	205
1½ inches of water every three weeks June–November	631
1½ inches of water every three weeks August–November	306

All the yield figures in Table 17 differ significantly (P=0·01).

Plant Breeding and Selection.

In the Uwemba area the work of selecting and propagating improved pyrethrum varieties continued. In all more than 1,000 clones, each derived from a single plant, are being examined. Some improved planting material has been issued to local groweres and co-operative societies but it will not be possible to make definite recommendations until the individual clones have been tested in replicated experiments. This work will be started at the Igeri sub-station at the end of 1962.

A number of isolated crossing plots have been established to produce seed of known parentage from specific pairs of clones. Hybrid material from these crosses will be tested alongside the parent clones from 1962 onwards.

Rice

Plant Breeding and Selection.

Fifteen selections have been tested for five years at Mahiwa. None has given appreciably higher mean yields than the control, Lindi Safara. Afaa Kilombero (ex Mahiwa) gave a mean increase of 12 per cent and two lines of Afaa Mwanza 9 per cent.

Sesame

Plant Breeding and Selection.

Some 3,500 F_4 line rows were grown, average yields were generally low, 400–600 lb. per acre, but some lines from the Local × Morada cross and Inamar × Acarigua cross show strong indications of producing much better varieties than either of the parents. The characters used previously for producing indehiscent varieties are not sufficiently promising to justify continued effort. Varieties with three different characters of value in this connection have been obtained from the U.S.A. and a new breeding programme has started.

Sisal

Plant Protection.

In the past, reports of diseases on sisal have been concerned with physiological upsets and apparently secondary fungal infections. But the planting of the more rapidly growing hybrid 11648, in limited areas on a number of estates, has changed this picture. Early reports of trouble in 1960 have been followed by others. Three definite sets of symptoms are now recognized, zebra leaf-spot, spike rot and bole rot.

One pathologist is now working full-time on these problems and although a lot of information has been obtained much remains to be done in isolating the causal organisms before positive control measures can be formulated.

Soya Beans

Agronomy.

Yields of soya beans are not particularly high in Lake Region but some of the new higher yielding varieties may make it a useful minor cash crop.

At Seatondale (Iringa) Rhodesian Dwarf 279 yielded little better than Light Speckled had done in the previous year. The best (earliest) planting yielded 418 lb. per acre. The crop was unfertilized.

At Tengeru four Rhodesian varieties gave similar mean yields of between 1,044 and 1,200 lb. per acre.

Plant Breeding and Selection.

Of the nine new varieties issued in 1959 at Nachingwea six have yielded very well in farm production.

In general the best of the newest varieties are derived from Hernon 237 × Light Speckled crosses but a few from Benares × Light Speckled are also promising.

At Ilonga, the two varieties which gave high yields in 1960 again gave the highest yields but at a much lower level.

Sugar Cane

Plant Protection.

A further outbreak of sugar cane smut (*Ustilago scitaminea*) was confirmed on an isolated estate in the West Lake Region. The outbreak in the Northern Region has been kept in check. The cane collection has been certified free of the disease.

Tea

Agronomy.

At Maruku, the absolute necessity of mulch and sulphate of ammonia for good yields has been demonstrated. Plots receiving both have yielded 348 lb. and 192 lb. of made tea per acre in the absence and presence of shade in the first year after final prune. It is clear, however, from severe deficiency symptoms, that the crop cannot be maintained at Maruku without application of potash. Shade appears deleterious but windbreaks are needed.

Tobacco

Flue-cured

Agronomy.

At Urambo, it has been shown that the red soils are unsuitable for tobacco growing if the rainfall is less than the average but on the grey soils tobacco will thrive under near drought conditions.

Previous cropping of land has not greatly influenced the yield or grade index of tobacco.

TABLE 18

Effect of Previous Cropping on Yields (Lb. per Acre) and Quality of Flue-cured Tobacco at Urambo

Previous treatment	Yield	Grade Index	Crop Index
Grass, grass	944	2·66	2,508
Soya, Maize	923	2·67	2,464
Maize, Groundnuts	924	2·46	2,283
Groundnuts, Castor	961	2·56	2,459

The results of a wide range of experiments on fertilizer applications, rates of water application at planting, varieties and management fitted into the general pattern shown in previous years. Thus, the general methods by which tobacco should be grown at Urambo have been established.

Following six years work under the control of the Southern Highlands Non-Native Tobacco Board, Seatondale Experimental Station at Iringa came under Government control for the 1960-61 season. The programme was a continuation of the previous one. The aim being to provide information on the long-term seasonal effects of date of planting and rates and forms of nitrogen, phosphate and potash. Variety work was now confined to study of the "quality" varieties; the thin broad-leaved types, having served their purpose in the changeover from Ehlers, were now going out of commercial production. Some work was started on the use of soil fumigants. Hicks was the standard variety in all non-variety experiments.

Late planting greatly lowered returns but with the relatively dry November and December the big drop occurred between the end of December and mid-January plantings. There was a suggestion that the Hicks return declined less than that of Bonanza. With plantings in mid-December and mid-January 8 c.c. of D.D. per planting station produced a much greater return from the earlier planting.

There was a negligible yield response to any level of nitrogen and in the six experiments done quality was lowered to some extent by even 22 lb. N per acre (mean main effects). With higher rates the decline was rapid and substantial. At the optimum planting date for this season (mid-December) 22 lb. N per acre raised quality and thus increased the return.

Phosphate responses were marked but not as large as in previous years. There was no evidence of any interaction with either nitrogen or date of planting. Water-soluble phosphate gave a better return than mixtures of water- and citric-soluble forms and a significantly (P=0·01) better return than Minjingu (non-water soluble) phosphate.

Rates and form of potash again showed no effects on yield or return.

The use of D.D. soil fumigant on four different sites gave a mean increase in return of 43 per cent. More important, from the point of view of experiments, the treated plots had a very even growth. Unevenness has always been a notable feature of tobacco on Seatondale. The presence of root knot nematodes in the Iringa District was of course known but the results of this work give an indication of the losses caused by the pest.

Tobacco

Fire-cured

Agronomy.

Good responses were obtained at Suluti (Songea) from nitrogen but phosphate and potash had little effect. Nitrogen also raised quality.

TABLE 19

Mean Yields (Lb. per Acre) for Three Rates of Nitrogen and Phosphate on Fire-cured Tobacco at Suluti

N rate	Phosphate rate (lb. P_2O_5 per acre)			
(lb. per acre)...	0	40	50	Mean
0 ...	449	532	588	523
20 ...	684	623	688	665
40 ...	730	790	877	799
Mean ...	621	648	717	
L.S.D. Main means ...			5 per cent	99
			1 per cent	103

In a date-of-planting experiment, nitrogen and phosphate also gave increases in yield of the order of 200 lb. per acre. Dates of planting ranging from 30th December to 23rd February had little effect on yield or quality.

Low topping either without nitrogen or with a low application did not reduce yields, but with a high rate of nitrogen yields were considerably reduced without any increase in quality.

In the second year of the crop sequence experiment the highest returns were obtained after groundnuts in the first year. They were significantly (P=0·05) better than after millet or maize. Returns after tobacco and cowpea were intermediate between those after nuts and the grain crops.

Velvet Beans

Agronomy.

Very satisfactory yields of both crops were obtained at Tengeru by planting two rows of maize alternating with one row of velvet beans. In a maize experiment comparing rates of sulphate of ammonia with interplanting of velvet beans the latter gave maize yields roughly equivalent to those obtained by the use of 1½ cwt. sulphate of ammonia per acre. An experiment was laid down to further distinguish between seed and fodder varieties.

Plant Breeding and Selection.

Drought and, later, army worm attack severely interfered with the work and caused loss of some material being multiplied. Absence of rust hindered selection work but comparison of results with those obtained at Njoro (Kenya) has assisted with the selection of promising material.

Plant Potection.

Rust incidence was generally very low.